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CASE REPORT

Novel neointimal formation over sirolimus-eluting stents identified by coronary angioscopy and optical coherence tomography

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Summary Neointimal proliferation after sirolimus-eluting stent (SES) implantation is generally inhibited by the pharmacological effects of sirolimus in comparison to bare metal stent (BMS). Neointimal hyperplasia after BMS implantation is mainly composed of vascular smooth muscle cells, and is usually observed as a white mass by angioscopy and as a layer of uniform signal intensity without attenuation on optical coherence tomography (OCT). In this case, angioscopic color of the neointima covering the SES was obviously yellow and OCT signal patterns of the neointima showed rapid attenuation similar to lipid tissues in atherosclerotic lesions. These findings suggest that neointima within the SES is quite different from that of the BMS and may contain atherosclerotic components.

Introduction

Although neointimal growth inside the stent is seen as angiographic lumen loss, information on the neointimal characteristics is not available from coronary angiograms. Angioscopy provides direct visualization of the lumen and macroscopic diagnosis for intravascular structures. Optical coherence tomography (OCT) is also capable of tissue characterization on the basis of its signal patterns [1,2]. Neointimal hyperplasia, recognized as a white mass by angioscopy and as a rather thick layer of uniform signals without their attenuation by OCT [3,4], covers fully over the bare metal stent (BMS) within several months following its implantation (Fig. 1).

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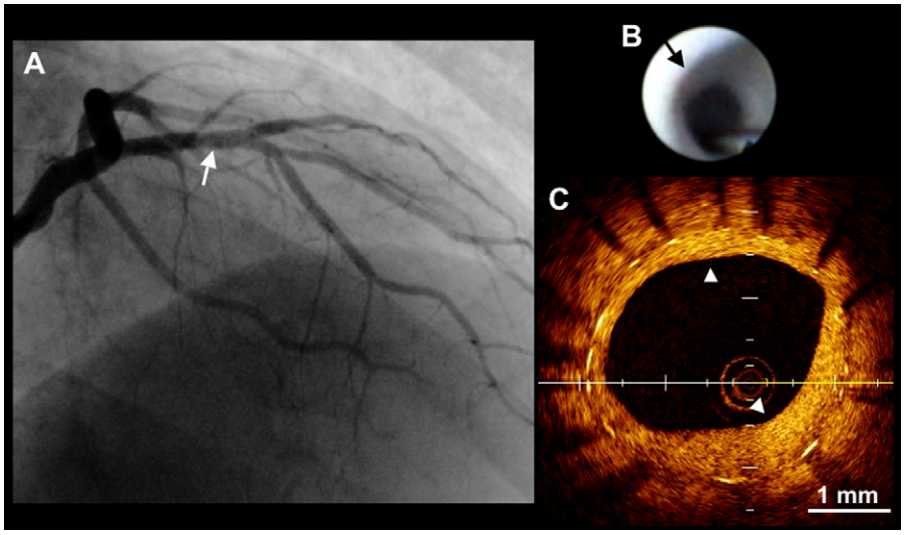

Figure 1 Typical findings of angioscopy, and optical coherence tomography after bare metal stent (BMS) implantation. (A) A 43-year-old man with stable angina pectoris received implantation of a BMS (3.5 mm × 13 mm) in the left anterior descending artery. Six-month follow-up angiogram shows no in-stent restenosis (arrow). (B) Angioscopy shows white neointima covers completely over the BMS (arrow) and the struts are invisible. (C) Circumferential stent struts with strong signals are identified by cross-sectional image of optical coherence tomography. Neointima inside the struts has uniform signals without their attenuation (arrowheads).

Case report

A 64-year-old man with stable angina pectoris underwent successful percutaneous coronary intervention. Three overlapping sirolimus-eluting stents (SESs) (3.5 mm × 18 mm, 3.5 mm × 23 mm, and 3.0 mm × 23 mm) were deployed for a diffuse long lesion in the left anterior descending artery. No in-stent restenosis within the SES segment was found on 6-month follow-up angiograms. Coronary angioscopy showed localized yellow neointima covered over the struts of the SES in the proximal overlapping segment. OCT images demonstrated that thin membrane inside the struts of this

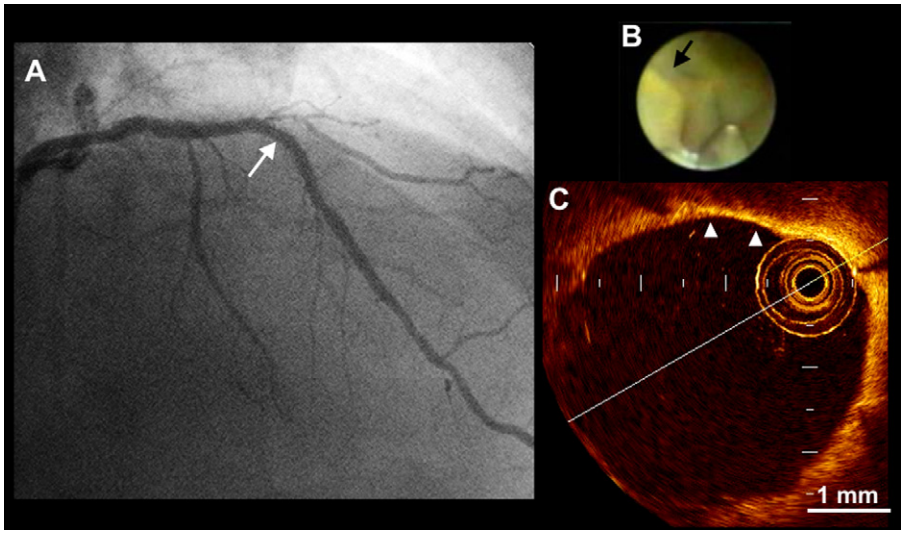

Figure 2 Novel findings of angioscopy and optical coherence tomography after sirolimus-eluting stents (SESs) implantation. (A) Three SESs were deployed in the left anterior descending artery. Six-month follow-up angiogram shows no in-stent restenosis (arrows). (B) Angioscopy shows yellow neointima covers over the SES (arrow), whereas some of the struts are uncovered in the proximal overlapping segment. (C) In this overlapping segment, thin membranous structure inside the struts of inner stent is partially recognized by optimal coherence tomography. Neointima has strong signals with their rapid attenuation similar to a lipid plaque (arrowheads). Although struts of inner stent are clearly seen, those of outer stent are not visible owing to backscattering of the neointima.

segment had high signal spots on the surface accompanying their rapid attenuation (Fig. 2).

Discussion

Although there are several reports on the progress in neointimal coverage after SES implantation [3—5], characteristics of the neointima have been little known. In the present case, appearance of the neointima over the SES was quite different from usual neointima inside the conventional BMS. The neointima had yellow color on the basis of angioscopic observation. Despite the fact that our OCT image quality was inadequate for circumferential evaluation of the coronary lumen because of noncentered image wire position [6], OCT pattern of the neointima clearly showed superficially strong signals with backscattering. According to established criteria for the coronary plaques based on angioscopic and OCT findings [1,2], characteristics of the neointima were consistent with a lipid tissue. Previous pathological examinations revealed that drug-eluting stent implantation-induced inflammatory responses, such as infiltration of several kinds of inflammatory cells, giant cells, T-lymphocytes, neutrophils, and macrophages around the struts [7—9]. Infiltrated macrophages in lipid-rich plaques in vivo are identified as high signal spots by OCT like this case [10]. The novel neointimal proliferation was found locally in the overlapping SES segment in this case. The expression of tissue factors included in advanced atherosclerotic plaques is enhanced by sirolimus [7,11]. In the overlapping segment, therefore, double layers of polymer and/or drug may evoke excessive inflammation and expression of tissue factors as an experimental study indicated [8]. To date, atherosclerosis is considered to be an inflammatory disease [12]. These inflammatory responses invited by SES may promote atherosclerotic changes of the tissue around stent struts including neointima. There is no pathological confirmation that lipid-like neointima based on the characteristics of intracoronary imaging devices actually contains lipid tissue, because the neointima is extremely thin and is unworthy of receiving directional coronary atherectomy. Although the precise mechanisms of appearance of the novel neointima are uncertain, the above inflammatory or atherosclerotic changes provoked by SES may affect the lipid-like neointima similar to atherosclerotic tissues. Our angioscopic and OCT images indicate that atherosclerotic process in the neointimal hyperplasia inside the SES may differ from that of the BMS.

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